

'Buy me some NEC!'

Crunch Time for Defence Acquisition

by Major Denis Thornton

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The great thing about NEC is that it is fairly easy to describe what sort of capabilities you might want to develop, but like all the best brain teasers it's not a case of where you want to finish up but rather more a case of where, and how do you start? Here on the WATCHKEEPER Programme we are developing a system that will be amongst the very first to leverage some of these concepts and field them in an integrated, NEC-ready capability. The challenges presented by integrating a complex ISTAR system with the array of legacy stovepipes that we field currently, have placed us at the leading edge of the wider challenge faced by defence acquisition as it re-orient itself to support the delivery of NEC.

Unfortunately for Project Teams in the NEC era, the defence acquisition model works well for stovepipes. When it comes to networked systems, the model is found wanting. Why should that be?

System Interaction

Fundamentally, systems are a product of organisations. The command system used by the Army works well because it has a direct relationship with the Army's hierarchical structure. In contrast, such an organisation does not suit irregular warfare or terrorist networks that operate in cells. In the animal kingdom, higher animals often congregate in hierarchical groupings, humans being one example. Contrasted with this are the lower orders of animals, such as termites, which have no hierarchical structure yet often display astounding levels of complex behaviour through the phenomenon of a hive mind:

their system of existence is a direct product of their organisation.

Military procurement, for so many years focused on the platform, has suited the hierarchical approach. A lack of horizontal communication, generally because there was little need for it, contributed to the system stovepipes that are in service today. For example, electronic surveillance aircraft enjoy excellent communications and interoperability with their parent organisations, but suffer from extremely poor availability of their wealth of data to anything else that could make use of it. Until now, no one *could* make use of it until it had been processed, but applications such as network-centric collaborative targeting (NCCT) are beginning to show that this should not remain the case.

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Up until now these stovepipes have been tolerable due to the military's *modus operandi* where vertical communication up and down chains of command is sufficient. In contrast, horizontal communication across the boundaries between systems and organisations is managed by people only when there is a perceived need. Liaison officers manage the friction caused by organisational boundaries; fusion teams such as G2 Cells manage the tasks and integrate the outputs of collection assets. In essence,

the military's operational methods have been driven by a symbiosis of doctrine, organisations and the systems available. This is reflected in the organisational stovepipes inherent in military support agencies, particularly those involved in logistics and acquisition. These agencies have evolved systems to support the elements involved in the core business of warfighting. Stovepipes at the sharp end are complemented by equally stovepiped systems further down the chain. The advent of NEC mounts an increasing and irresistible challenge to this situation. NEC can deliver great freedom to warfighters, or to put it another way, NEC can loosen many of the severe constraints that warfighters currently endure. Wide information availability, at all levels, will allow the purest application of Mission Command yet seen and unprecedented freedom of manoeuvre. Seamless system interaction will allow accurate and efficient identification, cross-cueing and prosecution of targets. But in order to place such systems in the hands of the warfighter, they have to be conceived, designed and procured many years before. If the systems are to be capable of working together in a variety of interactive ways, they must be grown together in order to do so.

A tall order? Absolutely. A revolution? Not really. Integrating disparate elements into a 'system of systems' is, by definition, the same challenge as integrating a component system in the first place. The scale is different, but the essential techniques are the same. Many successful projects involve hundreds, in some cases hundreds of thousands, of subsystems. It is a difficult task, but a task that is much harder between organisations than within them. The Apollo Moon missions represent one of the best, but by no means only,

examples of massive systems integration: each Apollo launched comprised over 100,000 interacting subsystems, many of them high-risk and all of them critical to mission success. No surprise, then, that a large proportion of the US\$20bn¹ pricetag was spent on systems engineering costs – essentially spending money to ensure effective, methodical and accurate horizontal communication between organisations.

Faster, Better, Cheaper?

There are many similarities between military acquisition and the US space programme: the technology is invariably risky, involving large numbers of systems that must work together extremely well; they are developed by large and organisationally separate teams to achieve a mission, rather than a proper business; and the cost of failure, frequently catastrophic when it occurs, is counted in careers and occasionally lives, rather than share prices.

It is also expensive, and in the 1990s this led NASA to field small teams on relatively low-risk endeavours to deploy a variety of probes, mainly to Mars. The Agency’s motto during this time was ‘Faster, Better, Cheaper’ (FBC). Some projects achieved this ideal, but many failed and the example of the Climate Orbiter that flew into, rather than around, Mars due to a mix-up between

metric and imperial units will be familiar to many. It was found that small teams communicated well informally, and so the safeguards of formal communication through systems engineering had been removed to save money.

Drive a Willing Horse

There is cause for optimism. Tight fiscal environments have forced change and demanded increased business agility from those charged with spending money on defence. For the most part today, we find organisations prepared to change, to make acquisition smarter and flexible enough to meet new challenges. In order to meet the challenge of NEC, however, there are three key, linked areas that must see improvement if the right systems are to be put in the hands of the warfighter.

Boundary Friction

The main reason why it is difficult to integrate beyond the core system boundary is usually because of the way key elements of organisations such as Project Teams differ in their internal and external communications. The same phenomenon can be seen between many organisations: it’s why the weakest part of an enemy is at the formation boundaries; it’s why the gas company digs the road up one week and the electricity firm moves in the next. Every organisation that boasts high

employee satisfaction will always have good vertical communications, but that does not necessarily mean that they deliver the best output. Organisations that have high employee satisfaction and also enjoy an extremely successful business can demonstrate that their vertical communications are complemented by excellent horizontal communications within, and outside, their organisation with both customers and partners. Largely self-synchronised, efficiently organised and with complementary goals supporting a common aim, delivery of best effect becomes a natural, unforced output.

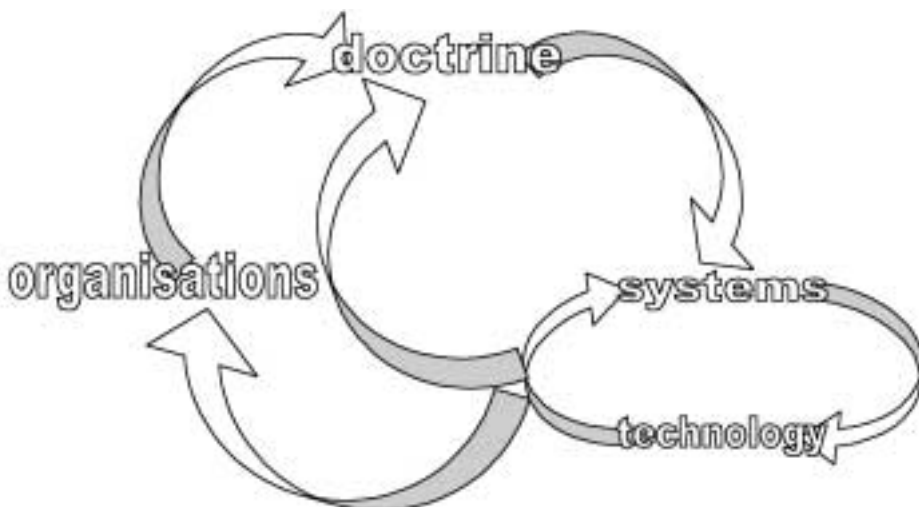
Informal horizontal

Communications will always exist, but this is not really enough when developing closely integrated systems on the scale that NEC demands. A small change to one system, critical in its effect on others, may be communicated informally by a team member, but how can you be sure that related changes will be passed on by that team member’s replacement a year later? So a degree of discipline needs to be applied to inter- and intra-organisational communications: not so much that it is constrained, but just enough to make it timely, methodical and accurate. Systems engineering is the proven means of achieving this, but it comes at a significant cost. Recent history, however, is littered with examples where it would have been money well spent. Network-enabled capabilities are likely to be few in number and modest in effect unless the effort is made, and the balance of investment is realigned, to ensure communication quantity and quality undergoes radical improvement.

Architectural Oversight

Acquisition organisations will want, and indeed require, as much operational and organisational flexibility as network-enabled warfighters in order to develop NEC systems. There is a danger here of over-egging the situation.

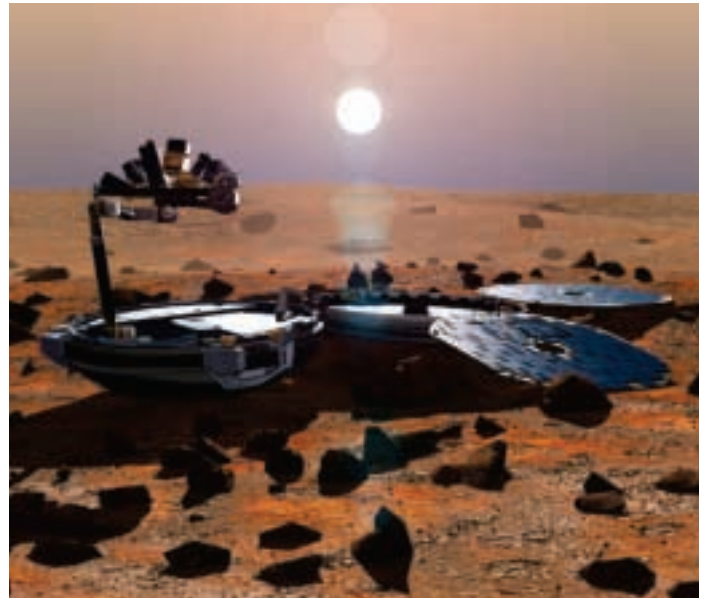
An architecture that provides and guides that common aim is clearly essential. But in order for the architects to deliver the aim



Key defence inter-dependencies.



Win: Mars Exploration Rover



Waste: Beagle 2.

they must be empowered to make changes where necessary. Their architecture needs to be coherent within emerging NEC doctrine, but also inform it to ensure that doctrine continues to develop. This demands world-class communication between the architects, warfighters, project teams and supporting agencies. These are by no means innovative recommendations, but as long as architectural and integration organisations remain advisory, rather than empowered to make change, it is not far-fetched to claim that NEC will be dead on arrival. Many organisations that lay claim to 'architect' or 'integrator' in military procurement do neither. Giving these organisations the real authority they need to guide, and where necessary, enforce coherence and communication between stakeholders, is essential to NEC's success.

Budgetary Stovepipes

Budgets are another form of boundary, but are worth highlighting in their own right. The term 'barrier' is probably more appropriate. This barrier stems from the financial standoff that occurs when two systems have to integrate. Both systems tend to make the effort up to their own system boundary – the euphemism here is 'technically interoperable' – but neither system can or will pay for the 'bit in the middle' that will allow practical interaction to take place.

The project team is left in something of a Catch-22 situation: if it develops NEC-type applications that can only be of use when networked with other systems, that application lies dormant and unused until the other system is networked with it.² The two systems are technically interoperable but practically discrete, so a choice must be made: invest money in a dormant capability that may never be used or forgo the dormant capability for a more immediate need. Dormant capabilities can be very hard to justify spending money on, but if the money is not spent then whither NEC?

Budgetary flexibility between projects could help ease this situation. Inherent reserves, rarely easy to contemplate at project start, would invariably alleviate unforeseen integration problems later on. Budgetary control by the architect/integrator organisation could ensure that the problem of 'who blinks first' in the financial standoff becomes a thing of the platform-centric past.

The Total Capability Fielded

Individual NEC systems, when not networked, should almost be a step backwards in stand-alone capability from the gold-plated stovepipe systems fielded in the past. The key advance is that when networked, these 80 per cent solutions can deliver a capability that far

outstrips the sum of its parts. In the same way that the mix of units in a battle group or air attack team add up to a recipe for success, so will successful systems interaction open up a new world of military capability.

To achieve this, we have to recognise that if our core business changes, little else can remain the same. The symbiotic relationship between doctrine, organisations, systems and technology will force our hand to change eventually, but at what cost, financially and worse?

Crunch Time

Elsewhere in this journal you will have the opportunity to read about what NEC will do for you, and the systems needed to make it happen. It will transform the future of warfare, of that there is little doubt. But before NEC gets to the battlefield, the war will already have been lost or won by the architects, project teams and budgeteers from years before. It may no longer be the playing fields of Eton, but the principle remains the same. ■

NOTES

1. 1970 prices. Equivalent today would exceed \$130Bn.
2. A simple example is cross-cueing between ISTAR systems such as ASTOR and WATCHKEEPER.